

[0029] The thermal stability of a carboxymethyl guar treating solution was compared to a sulfonated guar polymer treating solution of this invention. The polymer solutions were prepared at a concentration of 0.5 weight percent in deionized water. In two of the tests, a gel stabilizing agent comprised of sodium thiosulfate, was added as indicated in Table 3 below. The polymer solutions were hydrated at pH 7 and the viscosities were measured at 75°F. The solutions were sparged with nitrogen and heated in a pressure vessel under 100 psi to 300°F for 4 hours. The solutions were then cooled to 75°F and the viscosities were measured again.

[0030] As shown in Table 3, the solutions of sulfonated guar polymer had superior thermal stability compare to the carboxymethyl guar.

Table 3. Effect of Time and Temperature on Viscosity

<u>Sample</u>	<u>Gelling Agent Polymer</u>	<u>Gel Stabilizing Agentlb/1000 gal</u>	<u>Initial Viscosity cP @ 75 F</u>	<u>Final Viscosity cP @ 75 F*</u>	<u>% of Initial Viscosity*</u>
1	Carboxymethylguar	None	39.02	2.2	5.6
2	Carboxymethylguar	20	36.37	5.65	15.5
3	Sulfonated Guar	None	40.48	4.4	10.9
4	Sulfonated Guar	20	38.63	10.74	27.8

*after 4 hours at 300°F

[0031] Thus, the present invention is well adapted to carry out the objects and attain the ends and advantages mentioned as well as those that are inherent therein. While numerous changes can be made by those skilled in the art, such changes are encompassed within the spirit of this invention as defined by the appended claims.

[0032] What is claimed is:

1. A method of treating a subterranean formation penetrated by a well bore comprising the steps of:

(a) preparing or providing an aqueous treating fluid composition comprising water and a high ionic strength sulfonated gelling agent polymer; and

(b) introducing said aqueous treating fluid composition into said subterranean formation.

2. The method of claim 1 wherein said water is selected from the group consisting of fresh water and salt water.

3. The method of claim 1 wherein said sulfonated gelling agent polymer is selected from the group consisting of sulfonated gelling agent biopolymers, sulfonated synthetic gelling agent polymers, sulfonated gelling agent polysaccharides and sulfonated gelling agent polysaccharide derivatives.

4. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent biopolymer selected from the group consisting of sulfonated xanthan and sulfonated succinoglycon.

5. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated synthetic gelling agent polymer selected from the group consisting of sulfonated polyvinyl alcohol, sulfonated polyacrylamide, sulfonated polyacrylate and sulfonated polyacrilamide/acrylic acid copolymers.

6. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide selected from the group consisting of sulfonated galactomannan gums and sulfonated cellulose.

7. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent galactomannan gum selected from the group consisting of sulfonated guar gum, sulfonated gum arabic, sulfonated gum ghatti, sulfonated gum karaya, sulfonated tamarind gum and sulfonated locust bean gum.

8. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide derivative selected from the group consisting of sulfonated carboxyalkyl derivatives of guar, sulfonated hydroxyalkyl derivatives of guar and sulfonated cellulose derivatives.

9. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent cellulose derivative selected from the group consisting of sulfonated carboxymethylcellulose, sulfonated carboxymethylhydroxyethylcellulose, sulfonated hydroxyethylcellulose, sulfonated methylhydroxypropylcellulose, sulfonated methylcellulose, sulfonated ethylcellulose, sulfonated propylcellulose, sulfonated ethylcarboxymethylcellulose, sulfonated methylethylcellulose and sulfonated hydroxypropylmethylcellulose.

10. The method of claim 1 wherein said sulfonated gelling agent polymer is sulfonated guar.

11. The method of claim 1 wherein said sulfonated gelling agent polymer is a sulfonated hydroxypropyl guar derivative.

12. The method of claim 1 wherein said sulfonated gelling agent polymer is present in said aqueous treating fluid composition in an amount in the range of from about 20 lbs to about 60 lbs per 1000 gal of said aqueous treating fluid composition.

13. The method of claim 1 wherein said treating fluid composition further comprises a crosslinking agent.

14. The method of claim 13 wherein said crosslinking agent is selected from the group consisting of boron compounds, compounds that supply zirconium IV ions, compounds that supply titanium IV ions, aluminum compounds and compounds that supply antimony ions.

15. The method of claim 13 wherein said crosslinking agent is present in said aqueous treating fluid composition in an amount in the range of from about 2 lbs to about 40 lbs per 1000 gal of said aqueous treating fluid composition.

16. A method of forming one or more fractures in a subterranean zone penetrated by a well bore comprising the steps of:

(a) preparing or providing an aqueous fracturing fluid composition comprising water and a high ionic strength sulfonated gelling agent polymer; and

(b) introducing said aqueous fracturing fluid composition into said subterranean zone at a rate and pressure sufficient to form one or more fractures therein.

17. The method of claim 16 wherein said water is selected from the group consisting of fresh water and salt water.

18. The method of claim 16 wherein said sulfonated gelling agent polymer is selected from the group consisting of sulfonated gelling agent biopolymers, sulfonated synthetic gelling agent polymers, sulfonated gelling agent polysaccharides and sulfonated gelling agent polysaccharide derivatives.

19. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent biopolymer selected from the group consisting of sulfonated xanthan and sulfonated succinoglycon.

20. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated synthetic gelling agent polymer selected from the group consisting of sulfonated polyvinyl alcohol, sulfonated polyacrylamide, sulfonated polyacrylate and sulfonated polyacrilamide/acrylic acid copolymers.

21. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide selected from the group consisting of sulfonated galactomannan gums and sulfonated cellulose.

22. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent galactomannan gum selected from the group consisting of sulfonated guar gum, sulfonated gum arabic, sulfonated gum ghatti, sulfonated gum karaya, sulfonated tamarind gum and sulfonated locust bean gum.

23. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide derivative selected from the group consisting of

sulfonated carboxyalkyl derivatives of guar, sulfonated hydroxyalkyl derivatives of guar and sulfonated cellulose derivatives.

24. The method of claim 16 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent cellulose derivative selected from the group consisting of sulfonated carboxymethylcellulose, sulfonated carboxymethylhydroxyethylcellulose, sulfonated hydroxyethylcellulose, sulfonated methylhydroxypropylcellulose, sulfonated methylcellulose, sulfonated ethylcellulose, sulfonated propylcellulose, sulfonated ethylcarboxymethylcellulose, sulfonated methylethylcellulose and sulfonated hydroxypropylmethylcellulose.

25. The method of claim 16 wherein said sulfonated polymer is sulfonated guar.

26. The method of claim 16 wherein said sulfonated polymer is a sulfonated hydroxypropyl guar derivative.

27. The method of claim 16 wherein said sulfonated gelling agent polymer is present in said aqueous fracturing fluid composition in an amount in the range of from about 20 lbs to about 60 lbs per 1000 gal of said aqueous fracturing fluid composition.

28. The method of claim 16 wherein said aqueous fracturing fluid composition further comprises a crosslinking agent.

29. The method of claim 28 wherein said crosslinking agent is selected from the group consisting of boron compounds, compounds that supply zirconium IV ions, compounds that supply titanium IV ions, aluminum compounds and compounds that supply antimony ions.

30. The method of claim 28 wherein said crosslinking agent is present in said fracturing fluid composition in an amount in the range of from about 2 lbs to about 40 lbs per 1000 gal of said fracturing fluid composition.

31. An aqueous treating fluid composition for treating a subterranean formation comprising water and a high ionic strength sulfonated polymer.

32. The composition of claim 31 wherein said water is selected from the group consisting of fresh water and salt water.

33. The composition of claim 31 wherein said sulfonated gelling agent polymer is selected from the group consisting of sulfonated gelling agent biopolymers, sulfonated synthetic gelling agent polymers, sulfonated gelling agent polysaccharides and sulfonated gelling agent polysaccharide derivatives.

34. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent biopolymer selected from the group consisting of sulfonated xanthan and sulfonated succinoglycon.

35. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated synthetic gelling agent polymer selected from the group consisting of sulfonated polyvinyl alcohol, sulfonated polyacrylamide, sulfonated polyacrylate and sulfonated polyacrilamide/acrylic acid copolymers.

36. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide selected from the group consisting of sulfonated galactomannan gums and sulfonated cellulose.

37. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent galactomannan gum selected from the group consisting of sulfonated guar gum, sulfonated gum arabic, sulfonated gum ghatti, sulfonated gum karaya, sulfonated tamarind gum and sulfonated locust bean gum.

38. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide derivative selected from the group consisting of sulfonated carboxyalkyl derivatives of guar, sulfonated hydroxyalkyl derivatives of guar and sulfonated cellulose derivatives.

39. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent cellulose derivative selected from the group consisting of sulfonated carboxymethylcellulose, sulfonated carboxymethylhydroxyethylcellulose, sulfonated hydroxyethylcellulose, sulfonated methylhydroxypropylcellulose, sulfonated methylcellulose, sulfonated ethylcellulose, sulfonated propylcellulose, sulfonated ethylcarboxymethylcellulose, sulfonated methylethylcellulose and sulfonated hydroxypropylmethylcellulose.

40. The composition of claim 31 wherein said sulfonated gelling agent polymer is sulfonated guar.

41. The composition of claim 31 wherein said sulfonated gelling agent polymer is a sulfonated hydroxypropyl guar derivative.

42. The composition of claim 31 wherein said sulfonated gelling agent polymer is present in an amount in the range of from about 20 lbs to about 60 lbs per 1000 gal of said composition.

43. The composition of claim 31 wherein said aqueous treating fluid composition further comprises a crosslinking agent.

44. The composition of claim 43 wherein said crosslinking agent is selected from the group consisting of boron compounds, compounds that supply zirconium IV ions, compounds that supply titanium IV ions, aluminum compounds and compounds that supply antimony ions.

45. The composition of claim 43 wherein said crosslinking agent is present in said treating fluid composition in an amount in the range of from about 2 lbs to about 40 lbs per 1000 gal of said composition.

46. A high ionic strength sulfonated gelling agent polymer selected from the group consisting of sulfonated biopolymers, sulfonated synthetic gelling agent polymers, sulfonated gelling agent polysaccharides and sulfonated gelling agent polysacchride derivatives.

47. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent biopolymer selected from the group consisting of sulfonated xanthan and sulfonated succinoglycon.

48. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated synthetic gelling agent polymer selected from the group consisting of sulfonated polyvinyl alcohol, sulfonated polyacrylamide, sulfonated polyacrylate and sulfonated polyacrilamide/acrylic acid copolymers.

49. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide selected from the group consisting of sulfonated galactomannan gums and sulfonated cellulose.

50. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent galactomannan gum selected from the group consisting of sulfonated guar gum, sulfonated gum arabic, sulfonated gum ghatti, sulfonated gum karaya, sulfonated tamarind gum and sulfonated locust bean gum.

51. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent polysaccharide derivative selected from the group consisting of sulfonated carboxyalkyl derivatives of guar, sulfonated hydroxyalkyl derivatives of guar and sulfonated cellulose derivatives.

52. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated gelling agent cellulose derivative selected from the group consisting of sulfonated carboxymethylcellulose, sulfonated carboxymethylhydroxyethylcellulose, sulfonated hydroxyethylcellulose, sulfonated methylhydroxypropylcellulose, sulfonated methylcellulose, sulfonated ethylcellulose, sulfonated propylcellulose, sulfonated ethylcarboxymethylcellulose, sulfonated methylethylcellulose and sulfonated hydroxypropylmethylcellulose.

53. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is sulfonated guar.

54. The gelling agent polymer of claim 46 wherein said sulfonated gelling agent polymer is a sulfonated hydroxypropyl guar derivative.